FRIDAY, September 9, 1892.

Occultation of Jupiter by the Moon.

Watch keeping Pacific standard time. No allowance made for watch correction.

Three satellites precede the planet.

	First satellite hidden	$5^h\ 20^m$ A. M.
	Second " "	$5^h\ 30^m$ "
	Third " "	$5^h\ 31^m\ 45^s$ "
Immersion	First contact of *Jupiter* and Moon	$5^h\ 35^m$.
	Jupiter hidden	$5^h\ 36^m\ 45^s$.

While the planet was behind the moon I was called away and left the instrument in charge of a student, who did not succeed in making a record of the time of emersion.

The latitude of the Observatory is 47° 35′ 54″ North. The longitude is 122° 20′ 0″ West.

A LARGE SOUTHERN TELESCOPE.

By Prof. E. C. PICKERING,
Director of HARVARD COLLEGE OBSERVATORY.

The wide interest in astronomical research is well illustrated by the frequent gifts of large telescopes to astronomical observatories by wealthy donors who are not themselves professional students of astronomy. The number of these gifts is continually increasing, and in no department of science has greater liberality been displayed. Unfortunately, the wisdom shown in the selection of good locations for the telescopes has not equaled the generosity with which they have been given. Political or personal reasons, rather than the most favorable atmospheric conditions, have in almost all cases determined the site. These telescopes have been erected near the capitals of countries or near large universities, instead of in places where the meteorological conditions would permit the best results to be obtained. The very conditions of climate which render a country or city great are often those which are unfavorable to astronomical work. The climate of western Europe and of the eastern portion of the United States is not suited to good astronomical work, and yet these are the very

countries where nearly all the largest observatories of the world are situated. The great number of telescopes thus concentrated renders it extremely difficult for a new one to find a useful line of work. The donor may therefore be disappointed to find so small a return for his expenditure, and the opinion has become prevalent that we cannot expect much further progress in astronomy by means of instruments like those now in use. The imperfections of our atmosphere appear to limit our powers, and are more troublesome, relatively, with a large than with a small telescope. Accordingly it has not been the policy of the Harvard College Observatory to attempt to obtain a large telescope to be erected in Cambridge. In order to secure the greatest possible scientific return for its expenditures, large pieces of routine work have by preference been undertaken which could be done with smaller instruments. These conditions are now, however, changed. A station has been established by this Observatory near Arequipa, in Peru, at an altitude of more than eight thousand feet. During a large part of the year the sky of Arequipa is nearly cloudless. A telescope having an aperture of thirteen inches has been erected there, and has shown a remarkable degree of steadiness in the atmosphere. Night after night atmospheric conditions prevail, which occur only at rare intervals, if ever, in Cambridge. Several of the diffraction rings surrounding the brighter stars are visible, close doubles in which the components are much less than a second apart are readily separated, and powers can be constantly employed which are so high as to be almost useless in Cambridge. In many researches the gain is as great as if the aperture of the instrument was doubled. Another important advantage of this station is, that as it is sixteen degrees south of the equator, the southern stars are all visible. A few years ago a list was published of all the refracting telescopes having an aperture of 9.8 inches or more (*Sidereal Messenger*, 1884, p. 193). From this it appears that nearly all of the largest telescopes are north of latitude + 35°, although this region covers but little more than one-fifth of the entire surface of the earth. None of the seventeen largest and but one of the fifty-three largest telescopes are south of this region. Of the entire list of seventy-four, but four, having diameters of 15, 11, 10 and 10 inches, are south of +35°. The four largest telescopes north of + 35° have apertures of 36, 30, 29, and 27 inches respectively. But few telescopes of the largest size have been erected since this list was prepared, and the pro-

portion north and south is still about the same. It therefore appears that about one-quarter of the entire sky is either invisible to, or so low that it cannot be advantageously observed by, any large telescope. The Magellanic clouds, the great clusters in *Centaurus*, *Tucana* and *Dorado*, the variable star η *Argus*, and the dense portions of the Milky Way, in *Scorpius*, *Argo* and *Crux*, are included in this neglected region. Moreover, the planet *Mars* when nearest the earth is always far south. The study of the surface of this and of the other planets is greatly impeded by the unsteadiness of the air at most of the existing observatories. Even under the most favorable circumstances startling discoveries —relating, for example, to the existence of inhabitants in the planets—are not to be expected. Still it is believed that in no other way are we so likely to add to our knowledge of planetary detail as by the plan here proposed. The great aperture and focal length and the steadiness of the air will permit unusually high magnifying powers to be employed, and will give this instrument corresponding advantages in many directions,—for instance, in micrometric measures, especially of faint objects. It can be used equally for visual and photographic purposes; and in photographing clusters, small nebulæ, double stars, the moon, and the planets, it will have unequaled advantages.

A series of telescopes of the largest size (including four of the six largest, the telescopes of the Lick, Pulkowa, U. S. Naval, and McCormick Observatories) has been successfully constructed by the firm of ALVAN CLARK & SONS. But one member of the firm now survives, Mr. ALVAN G. CLARK; and he expresses a doubt whether he would be ready to undertake the construction of more than one large telescope in the future. The glass is obtained with difficulty, and often only after a delay of years. A pair of discs of excellent glass suitable for a telescope having an aperture of forty inches have been cast, and can now probably be purchased at cost, $16,000. The expense of grinding and mounting would be $92,000. A suitable building would cost at least $40,000. If the sum of $200,000 could be provided, it would permit the construction of this telescope, its erection in Peru, and the means of keeping it at work for several years. Subsequently, the other funds of this Observatory would secure its permanent employment. Since a station is already established by this Observatory in Peru, a great saving could be effected in supervision and similar expenses, which otherwise would render a much larger outlay necessary.

An opportunity is thus offered to a donor to have his name permanently attached to a refracting telescope, which, besides being the largest in the world, would be more favorably situated than almost any other, and would have a field of work comparatively new. The numerous gifts to this Observatory by residents of Boston and its vicinity prevent the request for a general subscription; but it is believed that if the matter is properly presented, some wealthy person may be found who would gladly make the requisite gift, in view of the strong probability that it will lead to a great advance in our knowledge of the heavenly bodies. Any one interested in this plan is invited to address the author of this article.

CAMBRIDGE, Mass., U. S. A., September, 1892.

ON THE RADIANT POINTS OF METEOR-SHOWERS.

BY W. H. S. MONCK, F. R. A. S.

The earlier observers of meteor-showers usually regarded them as of considerable duration, without any material change in the radiant. It was not until the connexion of certain showers with comets was pointed out that a shorter duration was generally adopted as agreeing best with the mathematical theory of the subject. But practical observers can hardly be said to have ever adopted the short-duration theory, and Mr. DENNING began to impugn it openly not long after the theory of SCHIAPARELLI had been generally adopted. In this he was supported by the late Mr. R. P. GREG, who held, in spite of theory, that the average duration of a meteor-shower was at least three weeks. I am not aware that Mr. DENNING has anywhere expressed an opinion as to the average duration, or as to whether stationary or long-enduring showers constitute the rule or the exception, but he seems to have established the existence of many such showers extending considerably beyond Mr. GREG'S three weeks. The object of the present paper is to show that stationary and long-enduring radiants are the rule, not the exception, and that the mathematical theory of the subject must to a considerable extent be recast in order to account for them. I shall endeavor to show this by an analysis of the radiants comprised in the first quadrant